WE CLAIM:

1. A burner assembly comprising:

a venturi cluster including at least two venturis, each said venturi having a main venturi body portion defining a burner conduit, a venturi inlet and a venturi outlet, each said venturi being arranged and adapted for (1) inducing a flow of air when a gaseous fuel is introduced into said inlet and allowed to pass through said conduit, (2) creating an ultra fuel lean mixture of said air and said fuel, and (3) discharging an ultra fuel lean mixture of air and fuel from its said outlet;

a collector having an inlet end that is connected to and arranged in fluid communication with the outlets of said venturis, whereby the respective ultra fuel lean mixtures of air and fuel discharged from said outlets are collected and intermixed to present a single ultra fuel lean mixed stream of air and fuel; and

a burner tip attached to and in fluid communication with an outlet end of said collector, said tip being adapted and arranged for receiving said single ultra fuel lean mixed stream of air and fuel from said collector and directing the same into a combustion zone.

2. A burner assembly as set forth in claim 1, wherein said tip is elongated and adapted and arranged for directing said single ultra fuel lean mixed stream out of said tip and into said zone in a generally radial direction relative to a longitudinal axis of said tip.

3. A burner assembly as set forth in claim 2, wherein said tip is adapted and arranged to create a round flat flame which surrounds said tip.

4. A burner assembly as set forth in claim 1, wherein said tip is elongated and adapted and arranged for directing said single ultra fuel lean mixed stream out of said tip and into said zone in a generally axial direction relative to a longitudinal axis of said tip.

5. A burner assembly as set forth in claim 4, wherein said tip is adapted and arranged to create a cylindrical flame which extends along said axis.

6. A burner assembly as set forth in claim 1, wherein said cluster includes at least three of said venturis.

7. A burner assembly as set forth in claim 6, wherein said cluster includes at least six of said venturis.

8. A burner assembly as set forth in claim 1, wherein the inlet end of each venturi is bell shaped.

9. A burner assembly as set forth in claim 8, wherein said tubes include straight portions that are arranged in substantial parallelism relative to one another.

10. A burner assembly as set forth in claim 6, wherein the inlet end of each venturi is bell shaped.

11. A burner assembly as set forth in claim 10, wherein said tubes include straight portions that are arranged in substantial parallelism relative to one another.

12. A burner assembly as set forth in claim 7, wherein the inlet end of each venturi is bell shaped.

13. A burner assembly as set forth in claim 12, wherein said tubes include straight portions that are arranged in substantial parallelism relative to one another.

14. A burner assembly as set forth in claim 1, wherein said venturis have essentially the same physical capacity.

15. A burner assembly as set forth in claim 1, wherein at least one of said venturis has a different physical capacity than another of said venturis.

16. A burner assembly as set forth in claim 6, wherein at least one of said venturis has a different physical capacity than another of said venturis.

17. A burner assembly as set forth in claim 7, wherein said venturis have essentially the same physical capacity.

18. A burner assembly as set forth in claim 7, wherein at least one of said venturis has a different physical capacity than another of said venturis.

19. A burner assembly as set forth in claim 1, wherein said collector is elongated and includes a central axis which extends between said ends thereof.

20. A burner assembly as set forth in claim 19, comprising a central fuel tube that extends through said collector along said axis.

21. A burner assembly as set forth in claim 20, wherein the inlet end of the collector includes a least two open segments and the outlets of the venturis are each connected in fluid communication with a respective segment.

22. A burner assembly as set forth in claim 6, wherein said collector is elongated and includes a central axis which extends between said ends thereof.

23. A burner assembly as set forth in claim 22, comprising a central fuel tube that extends through said collector along said axis.

24. A burner assembly as set forth in claim 23, wherein the inlet end of the collector includes a least three open segments and the outlets of the venturis are each connected in fluid communication with a respective segment, said segments being arranged in a series extending around said central fuel tube.

25. A burner assembly as set forth in claim 7, wherein said collector is elongated and includes a central axis which extends between said ends thereof.

26. A burner assembly as set forth in claim 25, comprising a central fuel tube that extends through said collector along said axis.

27. A burner assembly as set forth in claim 26, wherein the inlet end of the collector includes a least six open segments and the outlets of the venturis are each connected in fluid communication with a respective segment, said segments being arranged in a series extending around said central fuel tube.

28. A burner assembly as set forth in claim 21, wherein said central fuel tube extends through said burner tip and has a downstream end portion which projects through a centrally located opening at a downstream end of the burner tip.

29. A burner assembly as set forth in claim 28, wherein is included a fuel nozzle at the downstream end portion of the central fuel tube.

30. A burner assembly as set forth in claim 24, wherein said central fuel tube extends through said burner tip and has a downstream end portion which projects through a centrally located opening at a downstream end of the burner tip.

31. A burner assembly as set forth in claim 30, wherein is included a fuel nozzle at the downstream end portion of the central fuel tube.

32. A burner assembly as set forth in claim 27, wherein said central fuel tube extends through said burner tip and has a downstream end portion which projects through a centrally located opening at a downstream end of the burner tip.

33. A burner assembly as set forth in claim 32, wherein is included a fuel nozzle at the downstream end portion of the central fuel tube.

34. A burner assembly as set forth in claim 28, wherein said tip is elongated and adapted and arranged for directing said single ultra fuel lean mixed stream out of said tip and into said zone in a generally radial direction relative to a longitudinal axis of said tip.

35. A burner assembly as set forth in claim 34, wherein said tip is adapted and arranged to create a round flat flame which surrounds said tip.

36. A burner assembly as set forth in claim 28, wherein said tip is elongated and adapted and arranged for directing said single ultra fuel lean mixed stream out of said tip and into said zone in a generally axial direction relative to a longitudinal axis of said tip.

37. A burner assembly as set forth in claim 36, wherein said tip is adapted and arranged to create a cylindrical flame which extends along said axis.

38. A burner assembly as set forth in claim 30, wherein said tip is elongated and adapted and arranged for directing said single ultra fuel lean mixed stream out of said tip and into said zone in a generally radial direction relative to a longitudinal axis of said tip.

39. A burner assembly as set forth in claim 38, wherein said tip is adapted and arranged to create a round flat flame which surrounds said tip.

40. A burner assembly as set forth in claim 30, wherein said tip is elongated and adapted and arranged for directing said single ultra fuel lean mixed stream out of said tip and into said zone in a generally axial direction relative to a longitudinal axis of said tip.

41. A burner assembly as set forth in claim 40, wherein said tip is adapted and arranged to create a cylindrical flame which extends along said axis.

42. A burner assembly as set forth in claim 32, wherein said tip is elongated and adapted and arranged for directing said single ultra fuel lean mixed stream out of said tip and into said zone in a generally radial direction relative to a longitudinal axis of said tip.

43. A burner assembly as set forth in claim 42, wherein said tip is adapted and arranged to create a round flat flame which surrounds said tip.

44. A burner assembly as set forth in claim 32, wherein said tip is elongated and adapted and arranged for directing said single ultra fuel lean mixed stream out of said tip and into said zone in a generally axial direction relative to a longitudinal axis of said tip.

45. A burner assembly as set forth in claim 44, wherein said tip is adapted and arranged to create a cylindrical flame which extends along said axis.

46. A burner assembly as set forth in claim 35, wherein said fuel nozzle is adapted and arranged for providing secondary fuel to said combustion zone.

47. A burner assembly as set forth in claim 39, wherein said fuel nozzle is adapted and arranged for providing secondary fuel to said combustion zone.

48. A burner assembly as set forth in claim 43, wherein said fuel nozzle is adapted and arranged for providing secondary fuel to said combustion zone.

49. A burner assembly as set forth in claim 37, wherein said fuel nozzle is adapted and arranged to provide a continuous flame at a location in the zone which is spaced axially from said downstream end of the tip.

50. A burner assembly as set forth in claim 49, wherein said location is spaced far enough from said downstream end in said zone such that the velocity of the single mixed stream directed out of the tip into the proximity of the fuel nozzle is no greater than a flame sustaining velocity.

51. A burner assembly as set forth in claim 41, wherein said fuel nozzle is adapted and arranged to provide a continuous flame at a location in the zone which is spaced axially from said downstream end of the tip.

52. A burner assembly as set forth in claim 51, wherein said location is spaced far enough from said downstream end in said zone such that the velocity of the single mixed stream directed out of the tip into the proximity of the fuel nozzle is no greater than a flame sustaining velocity.

53. A burner assembly as set forth in claim 45, wherein said fuel nozzle is adapted and arranged to provide a continuous flame at a location in the zone which is spaced axially from said downstream end of the tip.

54. A burner assembly as set forth in claim 53, wherein said location is spaced far enough from said downstream end in said zone such that the velocity of the single mixed stream directed out of the tip into the proximity of the fuel nozzle is no greater than a flame sustaining velocity.

55. A burner assembly comprising:

a burner tube structure comprising an elongated burner conduit having spaced inlet and outlet ends, said conduit being adapted and arranged for directing a gaseous mixture comprising a fluid fuel and oxygen therealong from said inlet end to said outlet end;

a burner tip at the outlet end of said conduit, said burner tip having a central axis and a downstream end spaced from said outlet end of the conduit, said tip being arranged and adapted for receiving said mixture from the conduit and directing the same through one or more apertures at said downstream end into a combustion zone in a direction along said axis;

an elongated central fuel tube extending through said tip along said axis, said fuel tube projecting out of said tip in an axial direction through said downstream end, said fuel tube having a downstream end portion located in said zone in spaced relationship relative to said downstream end of the burner tip, said one or more apertures being disposed around said fuel tube, whereby the mixture directed into the combustion zone through said one or more apertures is generally in the form of a cylinder which surrounds said fuel tube and extends outwardly of the downstream end of the tip along said axis toward said downstream end portion of the fuel tube; and

a fuel nozzle on a said downstream end portion of the fuel tube, said fuel nozzle being located at a position in the zone which is sufficiently remote from said downstream end of the burner tip to permit the mixture to expand after it has left the downstream end of the tip and slow to a velocity which is less than the flame velocity thereof comes into proximity with the fuel nozzle.

56. A burner assembly as set forth in claim 55, wherein said mixture comprises a mixture of a gaseous fuel and air, and said burner tube structure comprises a venturi tube which uses a flow of said gaseous fuel to induce a flow of air, whereby to create said mixture.

57. A burner assembly as set forth in claim 55, wherein said mixture comprises a mixture of a gaseous fuel and air, and said burner tube structure comprises a plurality of venturi tubes arranged for parallel flow, each of said venturis being adapted and arranged to use a flow of said gaseous fuel to induce a flow of air, whereby to generate said mixture as an ultra fuel lean mixture of fuel and air.

58. A burner assembly as set forth in claim 55, wherein said burner tip includes an end wall at said downstream end thereof, said end wall including a plurality of said apertures and a central opening for said fuel tube.

59. A generally dome shaped burner tip comprising:

a generally ring shaped base portion having a central axis; and

a plurality of elongated, side-by-side, circumferentially spaced, longitudinally curved ribs which extend in a direction along said axis, said ribs each having a first end which is mounted on said base and a second end which is spaced from said base, said second ends being located nearer said axis than said first ends,

said base portion and said ribs defining an area inside the tip adapted for receiving a flow of a mixture of air and fluid fuel,

said ribs defining a multiplicity of curved slots therebetween permitting said mixture

to flow from said area and outwardly into a combustion zone outside said burner tip in both a radial direction and in a direction which includes a vector extending along said axis.

60. A burner tip as set forth in claim 59, comprising a crown portion connected to the second ends of said ribs.

61. A burner tip as set forth in claim 60, wherein said crown portion includes a plurality of axially and radially extending discontinuities which are aligned with respective slots such that the air/fluid fuel mixture flowing through the discontinuities has a more pronounced axial flow direction relative to the air/fluid fuel mixture flowing through the slots.

62. A burner tip as set forth in claim 61, wherein said discontinuities are positioned to cause the air/fluid fuel mixture flowing therethrough to create a prestaged mixing area outside said combustion zone.

63. A burner tip as set forth in claim 60, wherein said crown portion has an axially aligned, gas nozzle accommodating opening therein.

64. A burner assembly comprising a compound venturi structure and a burner tip as set forth in claim 59 located at a downstream end of the structure, said structure comprising:

a venturi cluster including at least two venturis, each of said venturis having an inlet, a throat and an outlet, and each being arranged and adapted for inducing the flow of an induced fluid by passing an inducing fluid therethrough, whereby respective mixtures of induced and inducing fluids are discharged from said outlets; and

a collector having an upstream end that is connected to and arranged in fluid communication with the outlets of said venturis, whereby the respective mixtures of inducing and induced fluids discharged from said outlets are collected and intermixed to present a single mixed stream of said fluids,

said burner tip being attached to and in fluid communication with an outlet end of said collector and being arranged for receiving said single mixed stream of fluids from said collector and distributing the same into a combustion zone.

65. A compound venturi cluster as set forth in claim 64, wherein said single mixed stream of fluids comprises fluid fuel and air.

66. A compound venturi cluster as set forth in claim 65, wherein said single mixed stream of fluids comprises an ultra fuel lean mixture of fluid fuel and air.

67. A method for increasing the capacity of a venturi device to induce the flow of an induced material into an inducing fluid when a flow of the inducing fluid is passed through the device, said method comprising:

separating said first fluid into at least two separate flow portions;

passing each separate flow portion of said first fluid through a respective venturi to independently induce a flow of said induced material into each of said flow portions thereby creating respective separate mixtures of said induced material and said inducing fluid; and

admixing the respective separate mixtures to thereby create an admixture of said inducing fluid and said induced material containing a greater concentration of said induced material than would be possible by passing the entire amount of said inducing fluid through a single venturi.

68. A method as set forth in claim 67, wherein said inducing fluid is separated into at least three of said separate flow portions.

69. A method as set forth in claim 67, wherein said inducing fluid is separated into at least six of said separate flow portions.

70. A method as set forth in claim 67, wherein said inducing fluid is a gaseous fuel.

71. A method as set forth in claim 70, wherein said induced material is air.

72. A method for decreasing the length of a venturi device adapted for inducing the flow of an induced material into an inducing fluid when a flow of the inducing fluid is passed through the device, said method comprising:

separating said inducing fluid into at least two separate flow portions;

passing each separate flow portion of said inducing fluid through a respective venturi to independently induce a flow of said induced material into each of said flow portions thereby creating respective separate mixtures of said induced material and said inducing fluid; and

admixing the respective separate mixtures to thereby create an admixture of said induced material and said inducing fluid containing a greater concentration of said induced material than would be possible by passing the entire amount of said inducing fluid through a single venturi of the same length.

73. A method for operating a venturi device comprising:

providing at least two venturis, each venturi having an inlet, a throat and an outlet, and each being operable for inducing the flow of an induced material when an inducing fluid is passed therethrough, whereby to produce a respective mixture of the induced material and the inducing fluid and discharging the mixture from the outlet thereof;

passing a first inducing fluid through a first of said venturis to thereby induce the flow of a first induced material and produce a first mixture comprising the first inducing fluid and the first induced material, and discharging said first mixture from the outlet of said first venturi;

passing a second inducing fluid through a second of said venturis to thereby induce

the flow of a second induced material and produce a second mixture comprising the second inducing fluid and the second induced material, and discharging said second mixture from the outlet of said second venturi; and

collecting and intermixing said first and second mixtures to present a single mixed stream of said fluids and materials.

74. A method for operating a burner equipped with a venturi device for supplying a combustible mixture to a burner nozzle, said method comprising:

providing at least two venturis, each venturi having an inlet, a throat and an outlet, and each being operable for inducing the flow of an induced fluid when an inducing fluid is passed therethrough, whereby to produce a respective mixture of the induced and inducing fluids and discharging the mixture from the outlet thereof;

passing a first inducing fluid through a first of said venturis to thereby induce the flow of a first induced fluid and produce a first mixture comprising the first inducing fluid and the first induced fluid, and discharging said first mixture from the outlet of said first venturi;

passing a second inducing fluid through a second of said venturis to thereby induce the flow of a second induced fluid and produce a second mixture comprising the second inducing fluid and the second induced fluid, and discharging said second mixture from the outlet of said second venturi; and

collecting and intermixing said first and second mixtures to present a single combustible mixed stream of said fluids.

75. A method as set forth in claim 74, wherein said first and second inducing fluids are each gaseous fuels.

76. A method as set forth in claim 75, wherein said first and second induced fluids are each air.

77. A method as set forth in claim 75, wherein said first induced fluid is air and said second induced fluid is a recirculated flue gas.

78. A method as set forth in claim 74, wherein one of said induced fluids is a diluent.

79. A method as set forth in claim 78, wherein said diluent is steam.

80. A method as set forth in claim 78, wherein said diluent is nitrogen.

81. A method for operating a burner comprising:

delivering a flow of a combustible mixture comprising a fuel and air from a nozzle to a combustion zone at composition where the flame speed of the mixture is lower than the velocity of the mixture as the latter exits the nozzle;

allowing the mixture to expand and thereby slow to a velocity which is no greater than said flame speed; and

igniting said mixture only after said velocity which is no greater than said flame speed has been achieved.

82. A method as set forth in claim 81, wherein said mixture is ultra fuel lean.

83. A method as set forth in claim 76, wherein said single combustible mixed stream of said fluids is fuel lean and the same is delivered to a combustion zone at a velocity which exceeds the flame speed of the mixture, said method further comprising:

allowing the mixed stream to expand and thereby slow to a velocity which is no greater than said flame speed; and

igniting said mixed stream only after said velocity which is no greater than said flame speed has been achieved.

84. A method as set forth in claim 67, wherein said material is a fluid.

85. A method as set forth in claim 67, wherein said material is a flowable solid.

86. A method as set forth in claim 72, wherein said material is a fluid.

87. A method as set forth in claim 72, wherein said material is a flowable solid.

88. A method as set forth in claim 73, wherein said material is a fluid.

89. A method as set forth in claim 73, wherein said material is a flowable solid.

90. A burner assembly as set forth in claim 39, wherein said diluent is CO_2.

91. A burner assembly as set forth in claim 20, wherein an upstream end of said central fuel tube is adapted for connection to a source of fuel.

92. A burner assembly as set forth in claim 20, wherein an upstream end of said central fuel tube is adapted for connection to a source of an air/fuel premix.

93. A burner assembly as set forth in claim 92, wherein said burner assembly includes a venturi connected at said upstream end of the central fuel tube.

94. A burner assembly as set forth in claim 92, wherein said burner assembly includes a multi-venturi cluster connected at said upstream end of the central fuel tube.

95. A burner assembly as set forth in claim 26, wherein an upstream end of said central fuel tube is adapted for connection to a source of fuel.

96. A burner assembly as set forth in claim 26, wherein an upstream end of said central fuel tube is adapted for connection to a source of an air/fuel premix.

97. A burner assembly as set forth in claim 96, wherein said burner assembly includes a venturi connected at said upstream end of the central fuel tube.

98. A burner assembly as set forth in claim 96, wherein said burner assembly includes a multi-venturi cluster connected at said upstream end of the central fuel tube.

99. A burner assembly as set forth in claim 1, wherein said venturis are adapted and arranged such that said ultra fuel lean mixture includes all of the air necessary to support the combustion of the fuel supplied to said combustion zone.

100. A burner assembly as set forth in claim 46, wherein said venturis are adapted and arranged such that said ultra fuel lean mixture includes all of the air necessary to support the combustion of the fuel supplied to said combustion zone.

101. A burner assembly as set forth in claim 47, wherein said venturis are adapted and arranged such that said ultra fuel lean mixture includes all of the air necessary to support the combustion of the fuel supplied to said combustion zone.

102. A burner assembly as set forth in claim 48, wherein said venturis are adapted and arranged such that said ultra fuel lean mixture includes all of the air necessary to support the combustion of the fuel supplied to said combustion zone.

103. A burner assembly as set forth in claim 1, including a secondary fuel nozzle for supplying additional fuel to said combustion zone.

104. A burner assembly as set forth in claim 103, wherein said venturis are adapted and arranged such that said ultra fuel lean mixture includes all of the air necessary to support the combustion of the fuel supplied to said combustion zone.

105. A burner assembly as set forth in claim 6, wherein said venturis have essentially the same physical capacity.